Chromosome numbers of five species of Lamium (Labiatae) in Japan

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Norihito Miura[1], Yoshikane Iwatsubo[2] and Naohiro Naruhashi[2] : **Chromosome numbers of five species of *Lamium* (Labiatae) in Japan**

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The genus *Lamium* L. (Labiatae), distributed in the north of Africa and Eurasia, comprises about 40 species (Mabberley 1997). In Japan the following six species including two naturalized species occur : *L. album* var. *barbatum, L. amplexicaule, L. humile, L. hybridum, L. purpureum* and *L. tuberiferum* (Murata and Yamazaki 1993 ; Murata 2003). As shown in Table 2, chromosome number of the *Lamium* taxa distributed in Japan is known for the following four species : *L. album* var. *barbatum* : n=9 and 2n=18 ; *L. amplexicaule* : n=9 and 2n=18 ; *L. hybridum* : n=18 and 2n=36 ; and *L. purpureum* : n=9, 2n=14 and 18. Except for a report of 2n=14 chromosomes in *L. purpureum* from SW Finland (Arohonka 1982, sec. Goldblatt 1988), the counts reported for these species correspond to the basic chromosome number of x=9 proposed for the genus by Darlington and Wylie (1955). In the course of our cytological studies for Japanese Labiatae, the authors found 2n=34 chromosomes, along with 2n=18 and 36 chromosomes in *Lamium*. This paper reports on the somatic chromosome numbers of *L. album* var. *barbatum, L. amplexicaule, L. humile, L. hybridum* and *L. purpureum* in Japan.

Materials and methods

A total of 28 individuals of *Lamium album* L. var. *barbatum* (Siebold et Zucc.) Franch. et Sav., *L. amplexicaule* L., *L. humile* (Miq.) Maxim., *L. hybridum* Vill. and *L. purpureum* L. collected from eight localities were used for the study (Table 1). These plants were cultivated in plastic pots at the experimental garden of University of Toyama, Japan. Their root tips were pretreated in 2.0 or 2.1 mM 8-hydroxyquinoline solution at approximately 25℃ for 1 h and then kept at 6℃ for 15 h. They were fixed in a mixture of glacial acetic acid and ethyl alcohol (1 : 3) for 1 h, soaked in 1 N HCl at room temperature for 1 h, macerated in 1 N HCl at 60℃ for 10 minutes, and then washed in tap water. The root tips were stained in a drop of 1.5% lacto-propionic orcein on the slide glass, and ordinary squash technique was applied for the examination of somatic chromosomes. Voucher specimens of these plants are deposited in the Toyama Science Museum (TOYA).

Results and discussion

Chromosome counts in the five taxa were as follows :

Lamium album var. *barbatum*

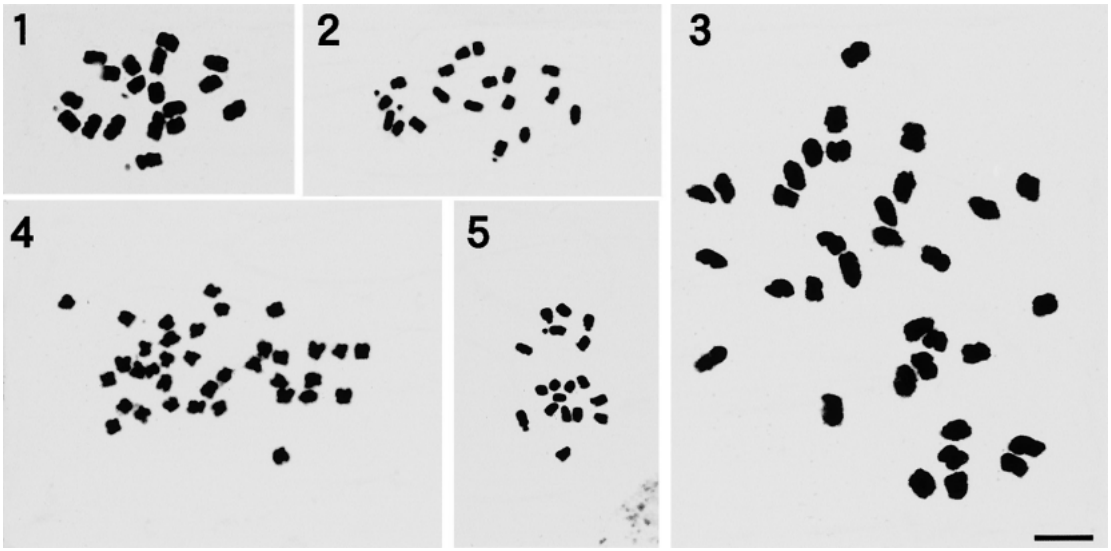
Two individuals collected from two localities (Table 1) were examined. They had 2n=18 chromosomes, (Fig. 1, Table 2) which verified the counts reported previously for this taxon (Tanaka 1974 ; Terasaka and Tanaka 1974 ; Starodubtsev 1985, as *L. barbatum* ; Sokolovskaya et al. 1986, as *L. barbatum* ; Nishikawa 1981 ; Rudyka 1995, as *L. barbatum*).

Lamium amplexicaule

Six individuals collected from two localities listed in Table 1 were investigated. All showed 2n =18 chromosomes (Fig. 2). As shown in Table 2, the count found in the present study agreed with almost all the counts reported previously for this taxon.

Lamium humile

Four individuals collected from one locality were investigated (Table 1). A chromosome count



Figs. 1–5. Somatic chromosomes of the five species in *Lamium* of Japan. 1 : *L. album* var. *barbatum* (2n=18). 2 : *L. amplexicaule* (2n=18). 3 : *L. humile* (2n=34). 4 : *L. hybridum* (2n=36). 5 : *L. purpureum* (2n=18). Bar indicates 5 μm.

Table 1. Collection localities and number of individuals examined (in parenthesis) of *Lamium* in Japan

Taxon	Collection locality
L. album var. *barbatum*	**Toyama Pref.** : Gofuku, Toyama City, (1). **Ishikawa Pref.** : Fukami, Wajia City, (1).
L. amplexicaule	**Gunma Pref.** : Kamishiroi, Komochi-mura, Kitagunma-gun, (1). **Toyama Pref.** : Gofuku, Toyama City, (5).
L. humile	**Nara Pref.** : Akadani, Ootou-mura, Yoshino-gun, (4).
L. hybridum	**Gifu Pref.** : Kamigiri, Takayama City, (1).
L. purpureum	**Akita Pref.** : Nigorikawa, Akita City, (1) ; Detomachigomon, Honjo City, (1) ; Komeyama, Yuri-machi, Yuri-gun, (1). **Toyama Pref.** : Gofuku, Toyama City, (12).

of 2n=34 was obtained from all samples (Fig. 3, Table 2). This is the first report of chromosome number for this species.

Lamium hybridum

One individual was investigated (Table 1). This plant had 2n=36 chromosomes (Fig. 4), agreeing with all the previous reports (Bernström 1944, 1955, as n=18 ; Löve and Löve 1956; Morton 1973; Fernandes and Leitão 1984; Elena-Rosselló et al. 1988 ; Ortega-Olivencia and Ruíz-Tellez 1990, as n=18) (Table 2).

Lamium purpureum

In this species, n=9 and 2n=14, 18 chromosomes are known (Table 2). Fifteen individuals collected from four localities listed in Table 1 were investigated. These showed a somatic chromosome number of 2n=18 (Fig. 5, Table 2).

In *Lamium*, two somatic chromosome numbers, 2n=18 and 36, are known to be by far the most common (Fedorov 1969). On the basis of the chromosome numbers, the basic number of *Lamium* was considered as x=9 by Darlington and Wylie (1955). In this genus, a unique chromosome number of 2n=34 had been reported in *L. iranicum* Parsa (Aryavand 1977, as n=17). Present study disclosed that *L. humile* also has 2n=34 chromosomes. Their somatic chromosome numbers show that they have a basic chromosome number of x=17.

The Labiatae, which is composed of approximately 6,700 species of 252 genera (Mabberley 1997), has basic chromosome numbers of x=5–19, within the basic numbers both x=8 and 9 are the most common primary basic numbers, and x=17 is the most common secondary basic number (Singh 1995). In Labiatae the secondary basic number of x=17 is considered by Singh (1995) to arise as the result of combination between the

Table 2. Chromosome numbers of *Lamium* taxa used in the study

Taxon	Present count	Previous count		Reference
	(2n)	(n)	(2n)	
L. album var. *barbatum*	18	9		Terasaka and Tanaka (1974)
			18	Tanaka (1974), Starodubtsev (1985, as L. *barbatum* Siebold et Zucc.), Sokolovskaya et al. (1986), Nishikawa (1981), Rudyka (1995, as *L. barbatum* Siebold et Zucc.)
L. amplexicaule	18	9		Jörgensen (1927), Tischler (1934), Arohonka (1982, sec. Goldblatt 1988), Gill (1983), Saggoo and Bir (1983 a, 1983 b, 1986), Ortega-Olivencia and Ruíz-Tellez (1990)
			18	Bernström (1944, 1952, 1953a, 1955), Heiser and Whitaker (1948), Löve and Löve (1956), Strid (1965), Gadella and Kliphuis (1966), Skalinska et al. (1968), Májovsky et al. (1970), Dahlgren et al. (1971), Fernandes and Queirós (1971), Feráková (1972), Morton (1973), Löve and Kjellqvist (1974), Markova and Thu (1974), Aryavand (1977), Van den Brand et al. (1979), Strid and Franzén (1981), Gill (1983), Fernandes and Leitão (1984), Elena-Rosselló et al. (1988), Dobes et al. (1997)
L. humile	34			
L. hybridum	36	18		Bernström (1944, 1955), Ortega-Olivencia and Ruíz-Tellez (1990)
			36	Löve and Löve (1956), Morton (1973), Elena-Rosselló et al. (1988), Fernandes and Leitão (1984)
L. purpureum	18	9		Jörgensen (1927), Tischler (1934, 1937), Griesinger (1937), Gill (1983)
			14	Arohonka (1982, sec. Goldblatt 1988)
			18	Heitz (1926), Bernström (1944, 1953a, 1953b, 1955), Pólya (1949), Löve and Löve (1956), Sorsa (1963, as 2n=ca.18), Skalinska et al. (1968), Gadella and Kliphuis (1971), Morton (1973), Löve and Kjellqvist (1974), Markova and Thu (1974), Májovsky et al. (1976), Van den Brand et al. (1979), Fernandes and Leitão (1984), Elena-Rosselló et al. (1988), Hill (1989), Ortega-Olivencia and Ruíz-Tellez (1990)

two dissimilar primary numbers of 8 and 9. In *Lamium*, however, the primary basic number reported is merely 9, and 8 has not been found in any species in the genus. Thus, the basic chromosome number of x=17 found in both *L. humile* and *L. iranicum* seems to be arisen by a dysploidal change from 2n=36 chromosomes having a primary basic chromosome number of x=9 to 2n=34 chromosomes with the secondary basic chromosome number because a primary basic number of x=8, which is found in many genera in Labiatae, has not been known in any species in *Lamium*.

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三浦憲人[1]・岩坪美兼[2]・鳴橋直弘[2]：日本産オドリコソウ属 5 種の染色体数

オドリコソウ属のオドリコソウ（*L. album* var. *barbatum*），ホトケノザ（*L. amplexicaule*），ヤマジオウ（*L. humile*），モミジバヒメオドリコソウ（*L. hybridum*），それにヒメオドリコソウ（*L. purpurreum*）の染色体数を調べた。オドリコソウは 2n=18，ホトケノザは 2n=18，ヤマジオウは 2n=34，モミジバヒメオドリコソウは 2n=36，そしてヒメオドリコソウは 2n=18 であった。この属の染色体基本数は x=9 が知られていることから，オドリコソウとホトケノザは二倍体，モミジバヒメオドリコソウは四倍体であり，それらはいずれも過去の報告と一致した。ヤマジオウの染色体数は本研究により 2n=34 であることが初めて明らかにされ，染色体基本数は x=17 と判断された。

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